



**GOVT.DEGREE COLLEGE FOR WOMEN(A),  
SRIKAKULAM**

**DEPARTMENT OF PHYSICS**

**CROSS CUTTING ISSUES**

**2023-2024**

S.N O.	YEAR	COURSE	UNIT AND TOPIC	COURSE CODE	CROSS CUTTING ISSUES			
					PE	GENDE R	HV	EV& S
1	Sem 5	COURSE 6B:LOW TEMPERATURE PHYSICS	<b>Unit1: Production of Low Temperature:</b> Freezing mixtures, Joule-Thomson effect, Regenerative cooling,				✓	✓
			Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, Adiabatic demagnetization, Properties of materials at low temperatures,					✓
	Superconductivity			✓			✓	
	<b>UNIT-II MEASUREMENT OF LOW TEMPERATURE:</b> Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers,							
	<b>UNIT-III PRINCIPLES OF REFRIGERATION:</b> Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air conditioning			✓		✓	✓	
	Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants						✓	
	defrosting in a refrigerator, Refrigerant leakage and detection						✓	
	<b>UNIT-V APPLICATIONS OF LOW TEMPERATURE &amp; REFRIGERATION</b> Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI-Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system.			✓	✓	✓	✓	



3	II B.SC	HEAT & THERMODYNAMICS	<b>UNIT-II: Thermodynamics:</b> Carnot's engine and its efficiency, Carnot's theorem, Kelvin's and Clausius statements.				✓	
			Principle of refrigeration.				✓	✓
			<b>UNIT-III: Thermodynamic Potentials and Maxwell's equations:</b> Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations		✓			
			<b>UNIT-IV: Low temperature Physics</b> Methods for producing very low temperatures, Joule Kelvin effect, Liquefaction of air by Linde's method,		✓			✓
			Practical applications of substances at low temperatures.					✓
			<b>UNIT-V: Quantum theory of radiation:</b> Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation- Solar constant and its determination using Angstrom pyroheliometer,		✓			✓
4	SEM1 I BSC PHY HON	COURSE1:Essentials and Applications of Mathematical, Physical and Chemical Sciences	<b>UNIT I: ESSENTIALS OF MATHEMATICS:</b> <b>Complex Numbers</b> <i>Conjugation of complex number-De-Movire's Theorem".</i> <b>Trigonometric Ratios:</b> <b>Vectors:</b> <b>Statistical Measures:</b> Mean, Median, Mode of a data and					✓
			<b>UNIT II: ESSENTIALS OF PHYSICS:</b> Thermodynamics fundamentals & laws		✓			
			<b>UNIT III: ESSENTIALS OF CHEMISTRY: :</b> Importance of Chemistry in daily life - Branches of chemistry and significance- Biomolecules- carbohydrates, proteins, fats and vitamins.				✓	✓
			<b>UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS &amp; CHEMISTRY:</b> <b>Application of Physics in Industry and Technology:</b> Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies. <i>Remote sense and GIS. Physics in every day life.</i>				✓	✓
			<b>Application of Chemistry in Industry and Technology:</b> Chemical Manufacturing,					

			Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.				✓	✓	
			<b>UNIT V: ESSENTIALS OF COMPUTER SCIENCE:</b> Cryptography		✓	✓	✓	✓	
5		COURSE2: Advances in Mathematical, Physical and Chemical Sciences	<b>UNIT I: ADVANCES IN BASICS MATHEMATICS</b> Integration, Matrices,Limits and Differentiation		✓		✓	✓	
			<b>UNIT II: ADVANCES IN PHYSICS</b> Recent advances in the field of nanotechnology		✓		✓	✓	
			The idea of fourth generation of solar cells		✓		✓	✓	
			<b>UNIT III: ADVANCES IN CHEMISTRY:</b> Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method, <i>HSAB</i>			✓		✓	✓
			<b>UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS &amp; CHEMISTRY</b> Mathematical Modelling applications in physics and chemistry Devices,Textiles and Fabrics. Application of biophysics: Application of medical physics:		✓	✓	✓	✓	
			<b>UNIT V: Advanced Applications of computer Science</b> Networking devices					✓	
6	SEM2	COURSE3:Mechanics and Properties of Matter  MINOR COURSE 1:Mechanics and Properties of Matter	<b>UNIT-I: VECTOR ANALYSIS</b>  9hrs  Statement and proof of Gauss and Stokes theorems.		✓			✓	
			<b>UNIT-II: MECHANICS OF PARTICLES</b>  9hrs  Newton Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum,				✓	✓	

			<b>UNIT-III :MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA</b>		✓			✓
			Precession of a top, Gyroscope, Precession of the equinoxes.					
			Hook's law,Poisson's ratio		✓			✓
			<b>UNIT-IV: CENTRAL FORCES</b>		✓		✓	✓
			9hrs Derivation of Kepler's laws,Orbital velocity and launching velocity of satellite,Geostationary satellite.					
			<b>UNIT-V: SPECIAL THEORY OF RELATIVITY</b>					
			Galilean relativity, Absolute frames. Michelson-Morley experiment, The negative result. Postulates of special theory of relativity. Lorentz transformation, mass-energy relation.Four vector formalism and its significance.		✓		✓	✓
			<b>UNIT-I Simple Harmonic oscillations</b>					
			Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM,		✓		✓	✓
			torsion pendulum-measurements of rigidity modulus, compound pendulum-measurement of 'g', beats,				✓	✓
			<b>UNIT-II Damped and forced oscillations</b>					
			Damped and forced harmonic oscillators, amplitude resonance and velocity		✓			✓
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			resonance.sharpness of resonance, AC electrical oscillator					
			<b>UNIT-III vibrations</b> <b>Complex</b> 9hr Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.		✓			✓
			<b>UNIT-IV Vibrating Strings and Bars</b> modes of vibration of stretched string clamped at ends, overtones and harmonics.		✓			✓
			. Longitudinal vibrations in bars: Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.		✓			✓
			<b>UNIT-V Ultrasonics:</b> Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magneto strictive methods, detection of ultrasonics, determination of wavelength of ultrasonic waves.Applications and uses of ultrasonic waves.		✓	✓	✓	✓
			<b>UNIT-I Aberrations</b> Spherica,chromatic and mono chromatic aberrations.		✓	✓	✓	✓
			<b>UNIT-III Diffraction</b>		✓			✓

8	SEM 3	<p>COURSE5: Optics</p> <p><b>MINOR</b></p> <p>COURSE 2: OPTICS</p>	Fresnel and Fraunhofer diffraction, Fresnel's half period zones--zone plate					
			<p><b>UNIT-IV:Polarisation</b></p> <p>, Brewster's law- Mault's law-Nicol prism: polarizer and analyzer, , <b>Fresnel's theory of optical rotation (without mathematical treatment)</b>, determination of specific rotation by Laurent's half shade Polarimeter.</p>		✓			✓
			<p><b>UNIT-V Lasers and Holography</b></p> <p>-Types of lasers-He-Ne laser, Ruby laser-<b>semiconductor laser</b>, Applications of lasers. Holography:</p>		✓	✓	✓	✓
			Basic principle of holography-Gabor hologram and its limitations, Applications of holography.		✓	✓	✓	✓
9		<p>COURSE6: Heat and Thermodynamics</p>	<p><b>UNIT-I: KINETIC THEORY OF GASES:</b></p> <p>Kinetic Theory of gases- Introduction, Maxwell's law of distribution of molecular velocities,</p>		✓			✓
			<p><b>UNIT-II: THERMODYNAMICS:</b></p> <p>Carnot's engine and its efficiency, Carnot's theorem, , Second law of thermodynamics Entropy: Physical significance,</p>		✓			✓
			<p><b>UNIT-III: THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS:</b></p> <p>Thermodynamic Potentials- and their significance.</p>		✓			✓
			<p><b>UNIT-IV: LOW TEMPERATURE PHYSICS:</b></p>					

			<p>Methods for producing very low temperatures, Joule Kelvin effect, porous plug experiment, Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Production of low temperatures by adiabatic demagnetization</p>		✓		✓	✓
			<p><b>UNIT-V: QUANTUM THEORY OF RADIATION:</b></p> <p>.</p> <p>Wein's displacement law and Rayleigh- Jean's law (No derivations), Planck's law of black body radiation-, Solar constant and its determination using Angstrom pyro heliometer, Estimation of surface temperature of Sun.</p>		✓		✓	✓
			<p><b>UNIT I: PN JUNCTION DIODES</b></p> <p>P-N junction Diode, Formation of depletion region, Forward and Reverse bias Ideal Diode, Diode equation –Reverse saturation current – Tunnel Diode- Construction, working, V-I characteristics and Applications, Zenor diode – V I characteristics, Applications</p>		✓		✓	✓
10		<p><b>COURSE7:</b> Electronic Devices and Circuits</p>	<p><b>UNIT –II: BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING: (D.C)</b></p> <p>Configurations of Transistor - CB, CE, and CC, Input and Output Characteristics of CB and CE configurations. Hybrid parameters of</p>		✓		✓	✓

			a Transistor and equivalent circuit, BJT Transistor Biasing – Need for stabilization, Thermal runaway, Stability factor, Biasing methods - Voltage-Divider Bias					
			<b>UNIT-III: FIELD EFFECT TRANSISTORS &amp; POWER ELECTRONIC DEVICES –</b> Construction and working of JFET, MOSFET - Depletion-type, and Enhancement-Type MOSFETs. UJT- Construction, working, V-I characteristics. SCR – Construction, Working and Characteristics		✓		✓	✓
			<b>UNIT IV: PHOTO ELECTRIC DEVICES:</b> Light-Emitting Diodes (LEDs) - Construction, working, characteristics and Applications, IR Emitters, Photo diode - Construction, working characteristics and Applications, Phototransistors - Construction, working and characteristics, Applications, Structure and operation of LDR, Applications		✓	✓	✓	✓
			<b>UNIT-V: POWER SUPPLIES:</b> Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor- Zener diode as Voltage Regulator, Filters- choke input (inductor), L-section, $\pi$ -section filters. Three terminal fixed voltage IC-regulators (78XX and 79XX)		✓	✓	✓	✓
			<b>UNIT-I: OPERATIONAL AMPLIFIERS</b> a) Basic concepts of differential amplifier, Block diagram of op amp and its equivalent circuit, IC Diagram (IC 741), Ideal voltage transfer curve,					

11	<p><b>COURSE8: Analog and Digital Electronics Practical course</b></p>	<p>Open loop Op-Amp configurations- differential, inverting and non-inverting Op-Amps.</p> <p>b) Voltage Series Feedback Amplifier (Non-Inverting Op amp): Gain and Bandwidth derivations: Voltage Shunt Feedback Amplifier (Inverting Op amp): Gain and Bandwidth derivations</p>		✓	✓	✓	✓
		<p><b>UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS</b></p> <p>a) Characteristics of an Ideal and Practical Operational Amplifier (IC 741) Applications of Op-Amp.</p>		✓	✓	✓	✓
		<p><b>UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES</b></p> <p>a) Number Systems and Codes: Conversions</p> <p>b) Logic Gates: Construction and truth tables of OR, AND, NOT gates, Universal gates – Basic construction and truth tables of NOR &amp; NAND, Realization of logic gates using NAND and NOR, XOR and XNOR Logic gates symbol and their truth tables. De Morgan’s Laws, Boolean Laws, Simplification of Boolean Expressions using Boolean Laws.</p>		✓	✓	✓	✓
		<p><b>UNIT-IV: ARITHMETIC CIRCUITS &amp; DATA PROCESSING CIRCUITS</b></p> <p>a) Half Adder and Full Adder: Explanation of truth tables and Circuits. Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits, 4 - bit binary Adder/Subtractor.</p>		✓	✓	✓	✓

			b) Multiplexers - 2 to 1 Multiplexer, 4 to 1 multiplexer, De-multiplexers: 1 to 2 Demultiplexer, 1 to 4 Demultiplexer, Applications of Multiplexers and Demultiplexers Decoders: 1 of 2 decoders, 2 of 4 decoders, Encoders: 4 to 2 Encoder, 8 to 3 Encoder, Applications of decoders and encoders					
			<b>UNIT-V: SEQUENTIAL LOGIC CIRCUITS &amp; CODE CONVERTERS</b> a) Combinational Logic vs Sequential Logic Circuits, Sequential Logic circuits: Flip-flops, Basic NAND, NOR Latches, Clocked SR Flip-flop, JK Flip-flop, D Flip-flop, Master-Slave Flip-flop, Conversion of Flipflops. b) Code Converters: BCD to Decimal Converter, BCD to Gray Code Converter, BCD to 7 segmentDecoders		✓	✓	✓	✓


**Human values (HV)**

Human values are the principles, beliefs, and guidelines that people use to guide their daily lives.

**Gender**

Gender-based inequities in physics refer to the unfair treatment of people based on their gender in the field of physics. These inequities can occur in many ways, including:

**Lab education**

Gender-based inequities in physics labs can prevent students from developing skills that could help them succeed in science and their careers.

**Socio-cultural norms**

Socio-cultural norms and values can contribute to male dominance in physics. These norms can include gender stereotypes, cultural expectations about women's roles, and the need for full dedication to science.

**Teacher perceptions**

Teachers may report more gender differences than students, especially in learning characteristics. For example, teachers may perceive boys as showing more talent and interest in physics, while girls show more effort and self-regulation.

### **Achievement gaps**

Studies have found achievement gaps in physics, with female students having lower grades than male students.

### **Professional ethics (PE)**

Professional ethics in physics are the principles that guide how physicists should behave, including:

#### **Honesty**

Physicists should be truthful and avoid fabrication, falsification, and plagiarism. They should also document and share their research results.

#### **Respect**

Physicists should treat others with respect and fairness, and avoid abuse of power and bias. They should establish good relationships with colleagues, students, and subordinates.

### **Environmental sensitivity (EV&S)**

Environmental sensitivity in physics is a basic trait that describes an organism's ability to perceive, process, and respond to environmental stimuli.